

JAPANESE PATENT OFFICE  
PATENT JOURNAL (A)  
KOKAI PATENT APPLICATION NO. SHO 62[1987]-26936

Int. Cl.<sup>4</sup>: H 04 B 3/36

Sequence No. for Office Use: 7323-5K

Filing No.: Sho 60[1985]-166493

Filing Date: July 26, 1985

Publication Date: February 4, 1987

No. of Inventions: 1 (Total of 3 pages)

Examination Request: Not filed

**HEAT DISSIPATION BUFFERING STRUCTURE FOR SUBMARINE REPEATER**

Inventor: Yasunori Hitai  
NEC Corp.  
5-33-1 Shiba, Minato-ku, Tokyo

Applicant: NEC Corp.  
5-33-1 Shiba, Minato-ku, Tokyo

Agent: Susumi Uchihara, patent attorney

[There are no amendments to this patent.]

**Claim**

A heat dissipation buffering structure for a submarine repeater comprised of an internal unit for accommodating a repeater circuit, an outer package for accommodating the internal unit and protecting it from the external water pressure, and a thin metal plate including a rubber buffer arranged in the cylindrical space between the aforementioned internal unit and the outer package.

### Detailed explanation of the invention

#### Industrial application field

The present invention pertains to a heat dissipation buffering structure for a submarine repeater. In particular, the present invention pertains to a heat dissipation buffering structure for a submarine repeater that supports an internal unit having a repeater circuit accommodated in it with respect to an outer package, whose main task is water pressure protection, and is also used for heat dissipation and buffering of the internal unit.

#### Prior art

As shown in Figure 4, a conventional heat dissipation buffering structure for a submarine repeater is constituted by inserting cylindrical rubber buffer (12) adhered to the two ends of internal unit (1), metal cylinder (13) (see Figure 5) used for heat dissipation and embedded in the central portion on the outer periphery of internal unit (1), and multiple metallic springs (14) made of thin metal plate with a double-wing cross section and arranged around said metal cylinder (13) into the cylindrical space between internal unit (1) that accommodates a repeater circuit and outer package (5) that accommodates internal unit (1) and protects it from external water pressure as shown in Figure 3. When inserted into outer package (5), said metallic springs (14) are in pressurized contact with the inner surface of outer package (5) to apply pressure within a certain limit to both external package (5) and internal unit (1).

In such a conventional heat dissipation buffering structure for a submarine repeater, the heat generated by internal unit (1) is conducted to outer package (5) depending on the heat conduction via rubber buffer (12), metal cylinder (13), and metallic springs (14) as well as on the convective heat transfer of the gas sealed in the internal space (7) of outer package (5) and in cylindrical space (6).

#### Problems to be solved by the invention

As described above, since the aforementioned conventional heat dissipation buffering structure for a submarine repeater has rubber buffer (12) and metallic springs (14), heat conduction by rubber buffer (12) cannot be expected. On the other hand, since metallic springs (14) are also used to maintain a surface pressure on outer package (5) and internal unit (1), it is difficult to guarantee a contact area. In some cases, the material and shape of the metallic springs also limit the heat conduction that can be expected. In addition, according to the way that a conventional structure is constructed, one should not have great expectations for heat conduction due to convection of the sealed gas. Consequently, a conventional heat dissipation buffering structure is unable to effectively suppress a temperature rise when a large amount of heat is generated by internal unit (1).

### Means to solve the problems

In order to solve the aforementioned problems, the present invention provides a heat dissipation buffering structure for a submarine repeater comprised of an internal unit for accommodating a repeater circuit, an outer package for accommodating the internal unit and protecting it from external water pressure, and a thin metal plate including a rubber buffer arranged in the cylindrical space between the aforementioned internal unit and the outer package.

### Application example

In the following, the present invention will be explained in more detail with reference to figures.

Figures 1 and 2 are transverse and vertically cut cross-sectional views illustrating an application example of the present invention. The heat dissipation buffering structure disclosed in the present application example is constituted by inserting a pair of cylindrical rubber buffers (2) and a pair of cylindrical thin metal plates (3), which are adhered to rubber buffers (2) and are each bent in the middle to cover half of the inner and outer peripheral surfaces of said rubber buffers (2), into the cylindrical space (6) between internal unit (1) having a repeater circuit accommodated in it and outer package (5) that accommodates the internal unit and protects it from external water pressure. The half parts of rubber buffers (2) covered by metal plates (3) almost cover the two half outer peripheral surfaces of internal unit (1) and are adhered to internal unit (1). Rubber buffers (2) elastically support internal unit (1) with respect to outer package (5), and metal plates (3) form a path for heat dissipation.

Symbol (4) represents a metal piece inserted into the bent part of metal plate (3) in order to further improve the heat conduction between the contact surface of metal plate (3) with outer package (5) and the contact surface of the metal plate with internal unit (1).

In the heat dissipation buffering structure for a submarine repeater disclosed in the present invention, since thin metal plate (3) provides elasticity by the rubber buffer (2) included in it, its entire surface can be closely adhered to the inner surface of outer package (5) and the outer surface of internal unit (1). Therefore, heat conduction losses of the contact surface can be minimized.

Also, since metal plate (3) is not required to display spring characteristics, there is no limitation on the material. Consequently, it is also possible to use metals with good heat conduction characteristics so that a good heat conduction path can be formed.

### Effect of the invention

As explained above, according to the present invention, by arranging a thin metal plate including a rubber buffer in the cylindrical space between the outer package and the internal unit, the contact of the metal plate used for forming the heat conduction path with the inner and outer surfaces of the cylindrical space can be maintained easily and efficiently. Consequently, effective heat dissipation and buffering can be realized for the internal unit.

### Brief description of the figures

Figure 1 is a transverse cross-sectional view illustrating the heat dissipation buffering structure for a submarine repeater disclosed in an application example of the present invention.

Figure 2 is a vertically cut cross-sectional view along line II-II of the heat dissipation buffering structure shown in Figure 1.

Figure 3 is a cross-sectional view illustrating the general position relationship between the outer package and the internal unit of a submarine repeater.

Figure 4 is an oblique view illustrating a conventional heat dissipation buffering structure for a submarine repeater.

Figure 5 is a vertically cut cross-sectional view of the heat dissipation buffering structure shown in Figure 4.

- 1 Internal unit
- 2 Rubber buffer
- 3 Metal plate
- 4 Metal piece
- 5 Outer package
- 6 Cylindrical space
- 7 Internal space

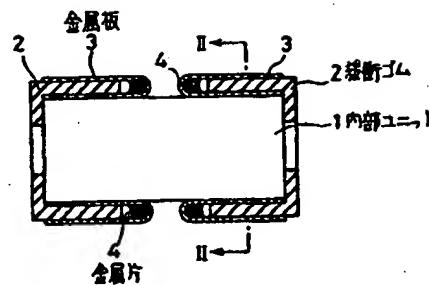


Figure 1

Key:

- 1 Internal unit
- 2 Rubber buffer
- 3 Metal plate
- 4 Metal piece

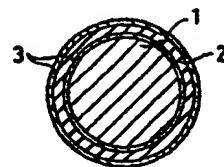


Figure 2

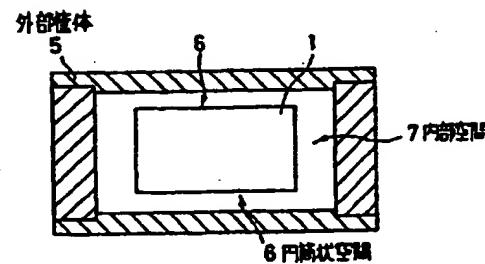


Figure 3

Key:

- 5 Outer package
- 6 Cylindrical space
- 7 Internal space

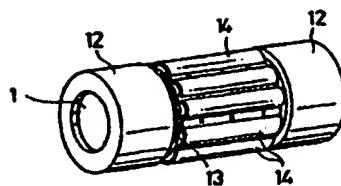


Figure 4

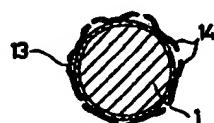


Figure 5